Name:	***Hazardous Materials Chemistry I***
Course Description:	This course provides basic fire chemistry relating to the categories of hazardous materials including problems of recognition, reactivity, and health encountered by firefighters.
Prerequisite:	None.
Outcomes:	1. Identify the common elements by their atomic symbols on the Periodic Table and demonstrate an understanding of why the table is organized into columns and groups. 2. Differentiate between elements, compounds and mixtures, and give examples of each. 3. Explain the difference between ionic and covalent bonding and be able to predict when each will occur. 4. Identify, name, and understand the basic chemistry involved with common hydrocarbon derivatives. 5. Comprehend the basic chemical and physical properties of gases, liquids and solids, and predict the behavior of a substance under adverse conditions. 6. Identify, name, and understand the basic chemistry and hazards involved with the nine U.S. Department of Transportation hazard classes and their divisions. 7. Analyze facility occupancy, transportation documents, shape and size of containers, and Material Safety Data Sheets (MSDS) to recognize the physical state and potential hazards of reactivity related to firefighter health and safety. 8. Demonstrate the ability to utilize guidebooks to determine an initial course of action for emergency responders. 9. Identify and analyze the causes involved in the line of duty firefighter deaths related to structural and wildland firefighting, training and research and the reduction of emergency risks and accidents.
Suggested Student Texts:	*Chemistry of Hazardous Materials*; Eugene Meyer, Brady, 2005 *Hazardous Materials Chemistry;* Armando Bevelacqua, Thomson, 2001 *The Common Sense Approach to Hazardous Materials*; Frank L. Fire, Pennwell, 1987

Supporting References/Research for Faculty and Students:	**U.S. Fire Administration** Publications: http://www.usfa.fema.gov/applications/publications/ See Fire Service Operations, Hazardous Materials, Terrorism Applied Research: http://www.usfa.fema.gov Research Reports: http://www.usfa.fema.gov/research Technical Reports: http://www.usfa.fema.gov/applications/publications/browse.cfm?mc=29 Topical Fire Research Series: http://www.usfa.fema.gov Learning Resource Center: http://www.lrc.fema.gov **National Institute for Standards and Technology** http://www.fire.nist.gov/ : Publications http://www.fire.nist.gov/aloft/ **References** North American Emergency Response Guidebook, U.S. Department of Transportation Hazardous Chemicals Desk Reference; Richard J. Lewis, Sr., John Wiley and Sons, Inc. Pocket Guide to Chemical Hazards, Center for Disease Control (CDC), National Institute of Occupational Health and Safety (NIOSH) Fire Protection Guide to Hazardous Materials, National Fire Protection Association (NFPA) Emergency Action Guides, Association of American Railroads and the U.S. Bureau of Explosives Lessons Learned Information Sharing: http://www.llis.dhs.gov/member/secure/index.cfm **Current Events/News** http://www.firehouse.com http://www.fireengineering.com http://www.withthecommand.com
Assessment:	Students will be evaluated for mastery of learning objectives by methods of evaluation to be determined by the instructor.
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Course Outline

Hazardous Materials Chemistry I

I. Introduction

- A. General Characteristics of Hazardous Materials
- B. Hazardous Household Products
- C. Hazardous Substances in the Workplace
- D. Hazardous Materials in Transit
- E. Hazardous Materials within Communities
- F. NFPA System of Identifying Potential Hazards

II. Matter and Energy

- A. Matter and Energy Defined
- B. Common Units of Measurement
- C. Temperature, Pressure, and Volume Relationships
- D. Heat Transmission
- E. Understanding Fluid Principles

III. Chemical Forms of Matter

- A. Elements and Compounds
- B. Periodic Classification of Elements
- C. The Nature of Chemical Bonding
- D. Writing Chemical Formulas
- E. Naming Ionic and Covalent Compounds

IV. Principles of Chemical Reactions

- A. Types of Chemical Reactions
- B. Factors Affecting the Rate of Reaction
- C. Oxidation-Reduction Reactions
- D. Fire Extinguishing Agents

V. Chemistry of Some Common Elements

- A. Oxygen
- B. Hydrogen
- C. Fluorine
- D. Chlorine
- E. Phosphorus
- F. Sulfur
- G. Carbon

VI. Flammable Gases and Liquids

- A. Flammability
- B. General Hazards of Compressed Gases
- C. Storage and Transport of Compressed Gases

D. General Hazards of Flammable Liquids
E. Storage and Transport of Flammable Liquids
F. Response to Flammable Gas and Liquid Emergencies

VII. Chemistry of Some Hazardous Organic Compounds

A. The Nature of Organic Compounds
B. Aliphatic Hydrocarbons
C. Aromatic Hydrocarbons
D. Functional Groups
E. Halogenated Hydrocarbons
F. Alcohols
G. Ethers
H. Aldehydes and Ketones
I. Organic Acids
J. Esters
K. Amines
L. Peroxo-Organic Compounds

VIII. Chemistry of Some Corrosive Materials

A. The Nature of Acids and Bases
B. The PH Scale
C. Acids and Bases as Corrosive Materials
D. Sulfuric Acid
E. Nitric Acid
F. Hydrochloric Acid
G. Perchloric Acid
H. Hydrofluoric Acid
I. Phosphoric Acid
J. Acetic Acid
K. Alkaline Metal Hydroxides
L. Response to Corrosive Material Emergencies

IX. Chemistry of Some Water-Reactive Materials

A. The Nature of Water Reactive Materials
B. Alkali Metals
C. Combustible Metals
D. Metallic Hydrides
E. Metallic Phosphides
F. Metallic Carbides

X. U.S. Department of Transportation Hazard Classes and Their Divisions

A. Identification of Hazardous Materials by Container Shape and Size
B. Identification of Hazardous Materials by Transportation Placards
C. Identification of Hazardous Materials by Shipping Documents
D. Identification of Hazardous Materials by Material Safety Data Sheets (MSDS)

XI. Hazardous Materials in Fixed Facilities

A. Identification of Hazardous Materials by Location and Occupancy
B. Identification of Hazardous Materials by Container Shape and Size
C. Identification of Hazardous Materials by NFPA 704 System
D. Identification of Hazardous Materials by Material Safety Data Sheets (MSDS)

XII. Response Guidelines

A. Utilization of North American Emergency Response Guidebook
B. Utilization of NIOSH Pocket Guide to Chemical Hazards
C. Utilization of NFPA Fire Protection Guide to Hazardous Materials
D. Utilization of Bureau of Explosives Emergency Action Guides